What is claimed is:

1. A method of calibrating a positioning stage, comprising the steps of:
(a) placing a substrate on the positioning stage, the substrate having a contrast film above a portion thereof, with at least one pattern at a predetermined location above the substrate, corresponding to a predetermined location on the positioning stage if the positioning stage has zero offset from a registration position;
(b) applying a beam to a position where the pattern on the substrate would be located if the positioning stage has zero offset;
(c) measuring at least one of the group consisting of reflected, transmitted and scattered portions of the beam; and
(d) detecting whether the positioning stage has a non-zero offset based on the measured portion of the beam.

2. The method of claim 1, wherein the measured portion of the beam has a first frequency distribution if the positioning stage has a zero offset, and a second frequency distribution if the positioning stage has a non-zero offset.

3. The method of claim 1, further comprising:
(e) moving the positioning stage if an offset is detected;
(f) repeating steps (b), (c), (d) and (e) until no offset is detected; and
(g) determining a magnitude and direction of the offset of the positioning stage based on a total distance and direction the positioning stage is moved.

4. The method of claim 1, wherein the beam is one of the group consisting of a Microwave, Infrared, Visible, UV, Xray, or Electron beam.

5. The method of claim 1, wherein the substrate is a semiconductor wafer, and the contrast film comprises at least one of the group consisting of photoresist, metal, oxide, and nitride.

6. The method of claim 1, wherein the substrate is an etch modified substrate.

7. The method of claim 1, wherein the substrate comprises a second film on at least a portion of the first film, and the method includes:

measuring reflected, transmitted or scattered portions of the beam from the second film; and

detecting whether the positioning stage has an offset based on the measured portion of the beam reflected, transmitted or scattered portions from the first film and the measured portion of the beam reflected, transmitted or scattered portions from the second film.

8. The method of claim 7, wherein the first film is a silicon oxide, and the second film is a photoresist

9. The method of claim 1, wherein the substrate includes a second pattern disposed at a different angular position on the substrate from the first pattern, the method further comprising:

determining a translation vector separating the first and second patterns; and

detecting an angular offset of the positioning stage, based on the translation vector.

10. The method of claim 1, wherein the substrate is a monitor wafer, the method further comprising, before step (a), the steps of:

depositing the contrast film on a bare semiconductor wafer; and

etching the pattern in the contrast film, to form the monitor wafer.

11. The method of claim 1, wherein the pattern includes a plurality of rectangles arranged around a perimeter of the substrate.

12. A system for calibrating a positioning stage, comprising:

a substrate adapted to be placed on the positioning stage, the substrate having a contrast film above a portion thereof, with at least one pattern at a predetermined location above the substrate, corresponding to a predetermined location on the positioning stage if the positioning stage has zero offset from a registration position;

a beam source that applies a beam to a position where the pattern on the substrate would be located if the positioning stage has zero offset;

a sensor for measuring at least one of the group consisting of reflected, transmitted and scattered portions of the beam; and

means for detecting whether the positioning stage has a non-zero offset based on the measured portion of the beam.

13. The system of claim 12, wherein the measured portion of the beam has a first frequency distribution if the positioning stage has a zero offset, and a second frequency distribution if the positioning stage has a non-zero offset.

14. The system of claim 12, wherein the beam includes at least one of the group consisting of a Microwave, Infrared, Visible, UV, Xray, or Electron beam.

15. The system of claim 12, wherein the contrast film comprises at least one of the group consisting of photoresist, metal, oxide, and nitride.

16. The system of claim 12, wherein the substrate is an etch-modified substrate.

17. The system of claim 12, wherein:

the substrate comprises a second film on at least a portion of the first film;

the sensor measures reflected, transmitted or scattered portions of the beam from the second film; and

the detecting means determines whether the positioning stage has an offset based on the measured portions of the beam reflected, transmitted or scattered from the first film and the measured portions of the beam reflected, transmitted or scattered from the second film.

18. The system of claim 17, wherein the first film is a silicon oxide, and the second film is a photoresist

19. The system of claim 12, wherein the substrate includes a second pattern disposed at a different angular position on the substrate from the first pattern, the system further comprising:

means for determining a translation vector separating the first and second patterns; and

means for detecting an angular offset of the positioning stage, based on the translation vector.

20. The system of claim 12, wherein the pattern includes a plurality of rectangles arranged around a perimeter of the substrate.

21. A monitor wafer, comprising:

a semiconductor substrate; and

a contrast film above the substrate, the contrast film including a plurality of positive or negative patterns of geometrical objects distributed at a plurality of respectively different angles with respect to a reference location on the substrate.

22. The monitor wafer of claim 21, wherein the plurality of geometrical objects includes four rectangles spaced 90 degrees apart.

23. The monitor wafer of claim 22, wherein the plurality of rectangles are located proximate to a circumference of the monitor wafer.

24. The monitor wafer of claim 21, wherein the contrast film comprises at least one of the group consisting of photoresist, metal, oxide, and nitride.

16. The monitor wafer of claim 21, wherein the monitor wafer includes an etch-modified substrate.

25. The monitor wafer of claim 21, wherein the pattern is a positive pattern, the plurality of geometrical objects includes a plurality of first rectangular contrast film portions, and the monitor wafer further includes a plurality of second rectangular contrast film portions on one or more of the first rectangular contrast film portions.

26. The monitor wafer of claim 25, wherein each second rectangular contrast film portion is smaller than the corresponding contrast film portion on which that second rectangular contrast film portion is located.

27. The monitor wafer of claim 26, wherein the substrate is silicon, the first film is a silicon oxide, and the second film is a photoresist.